

Draft

Lewis County Critical Areas Ordinance
Best Available Science Review and
Recommendations for Code Update
Frequently Flooded Areas

Prepared for



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TABLE OF CONTENTS

1. INTRODUCTION	1-1
1.1 REPORT BACKGROUND AND PURPOSE	1-1
1.2 RELATIONSHIP TO OTHER PLANNING EFFORTS	1-2
1.3 COUNTY SETTING	1-2
2. FREQUENTLY FLOODED AREAS	2-1
2.1 FLOODPLAIN FUNCTIONS AND VALUES	2-2
2.2 OVERVIEW OF INVENTORY	2-2
2.2.1 Existing Inventory	2-2
2.2.2 Past Major Floods	2-7
2.2.3 Updates to Inventory	2-8
2.2.4 Alluvial Fan Hazards and Channel Migration	2-8
2.3 HUMAN ACTIVITY AND FREQUENTLY FLOODED AREAS	2-9
2.4 FLOOD CONTROL PROJECTS	2-10
2.5 FLOOD HAZARD MANAGEMENT PLANNING	2-13
3. GAP ANALYSIS AND CODE OPTIONS	3-1
3.1 HIGHER FLOOD STANDARDS	3-2
3.2 RESTRICTIONS ON USES AND DENSITY	3-3
3.3 FLOODPROOFING	3-4
3.4 FINDINGS AND CODE RECOMMENDATIONS	3-1
4. FREQUENTLY FLOODED AREAS REFERENCES	4-1

LIST OF FIGURES

1	Vicinity Map	1-3
2	Frequently Flooded Areas	2-3
3	Frequently Flooded Areas Special Districts	2-11
4	Frequently Flooded Areas and Zoning	3-1

ACRONYMS

BAS	Best Available Science
BFE	base flood elevation
CAO	Critical Areas Ordinance
CARAs	Critical aquifer recharge areas
CFHMP	Comprehensive Flood Hazard Management Plan
CTED	Community Trade and Economic Development
CTP	Cooperative Technical Partnership
DEM	Department of Emergency Management
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRMs	Flood Insurance Rate Maps
GMA	Growth Management Act
HCAs	habitat conservation areas
HMP	Hazard Mitigation Plan
LCC	Lewis County Code
LCPW	Lewis County Public Works
LWD	large woody debris
NWS	National Weather Service
SCS	Soil Conservation Service
SMP	Shoreline Master Program
UGB	Urban Growth Boundary
USACE	U.S. Army Corps of Engineers
WRIAs	Water Resource Inventory Areas

1. INTRODUCTION

In 1995, the Washington State Legislature amended the Growth Management Act (GMA) to require that local governments include Best Available Science (BAS) in designating and protecting critical areas (RCW 36.70A.172(1)). In 2000, the State's Office of Community Trade and Economic Development (CTED) adopted procedural criteria to implement these changes to the GMA and provided guidance for identifying BAS. The rule makers concluded that identifying and describing functions and values and estimating the types and likely magnitudes of adverse impacts were scientific activities. Thus, RCW 36.70A.172(1) and the implementing regulations require the substantive inclusion of BAS in developing critical area policies and regulations.

This document summarizes BAS for Lewis County critical areas and provides recommendations for updating the County's Critical Areas Ordinance (CAO).

Critical areas as defined by RCW 36.70A.050, include the following:

- Geologically hazardous areas
- Frequently flooded areas
- Critical aquifer recharge areas (CARAs)
- Wetlands (both freshwater and estuarine)
- Fish and wildlife habitat conservation areas (HCAs)

In addition, this document addresses the habitat requirements and management needs of anadromous fish, and discusses habitat mitigation banking. Maps of the County's critical areas are provided in Appendix A.

1.1 REPORT BACKGROUND AND PURPOSE

The information contained within this document is a summary of scientific studies related to designating and protecting critical areas, including habitat for anadromous fish species, as defined by the GMA. The information provides a basis for recommended changes and additions to the Lewis County CAO¹. It is not intended to provide an exhaustive summary of all science available for all critical areas. The information reviewed is pertinent to Lewis County, applicable to the types of critical areas present, and is believed to be the best available scientific information. BAS² means current scientific information derived from research, monitoring, inventory, survey, modeling, assessment, synthesis, and expert opinion that is:

- Logical and reasonable
- Based on quantitative analysis
- Peer reviewed
- Used in the appropriate context
- Based on accepted methods
- Well referenced

¹ In some instances, the BAS review supports existing provisions of the County code and no changes are recommended.

² Washington Administrative Code (WAC) 365-195-900 through 925

Each chapter of the report is devoted to a specific critical area as designated in LCC 17.25. In many cases, the information presented for one critical area overlaps, complements, or is applicable to another type of critical area because these areas function as integrated components of the ecosystem. The chapters summarize the information and issues that the County is required to consider within its process for updating policies and regulations to protect the functions and values of critical areas (RCW 36.70A.172.1).

In some instances the GMA and its regulations constrain the choice of science that can be used to designate or protect a particular resource (e.g., local governments are required to use the definition of wetlands [RCW 36.70A.030.2]). In other cases, there may a range of options that are supported by science (e.g., wetland buffer widths necessary to protect functions).

The State Legislature and the Growth Management Hearings Boards have defined critical area “protection” to mean preservation of critical area “structure, function, and value.” Local governments are not required to protect all functions and values of all critical areas, but are required to achieve “no net loss” of critical area functions and values across the jurisdictional landscape. Local governments are also required to develop regulations that reduce hazards associated with some types of critical areas including geologically hazardous areas and frequently flooded areas. The standard of protection is to prevent adverse impacts to critical areas, to mitigate adverse impacts, and/or reduce risks associated with hazard areas.

1.2 RELATIONSHIP TO OTHER PLANNING EFFORTS

The recommendations derived from the BAS review will be used as the basis for revising the County’s development regulations and Comprehensive Plan elements that pertain to critical areas. The County is required to integrate critical areas protection into zoning regulations, clearing and grading provisions, stormwater management requirements, subdivisions regulations and other applicable plans and policies. The County is also required to integrate the CAO provisions with its Shoreline Master Program (SMP), which must be updated by the end of 2012. To comply with House Bill 1933, SMP regulations pertaining to critical areas must be as protective or more protective of functions and values as the CAO regulations themselves.

1.3 COUNTY SETTING

Lewis County encompasses 2,452 square miles in the southwest portion of the state. The crest of the Cascade Mountains forms the eastern boundary of the county. The County is abutted to the east by Yakima County and the Yakima Indian Reservation. It is bounded by Thurston and Pierce Counties to the north, Pacific County to the west, and Wahkiakum, Cowlitz, and Skamania Counties to the south (Figure 1).

Figure 1. Vicinity Map

The County includes the cities of Centralia, Chehalis, Winlock, Napavine, Morton, Mossyrock, Pe Ell, Toledo, and Vader. Approximately 60 percent of the County population of 71,000 lives in unincorporated areas outside of cities. Lewis County's two largest cities, Centralia and Chehalis, are located in the western portion of the county and have a population of about 15,350 and 7,000, respectively.

Federal lands within Lewis County include portions of the Mt. Baker/Snoqualmie National Forest, Gifford Pinchot National Forest, Mt. St. Helens National Volcanic Monument, Mt. Rainier National Park, and Goat Rock Wilderness Area. Reservation and trust lands of the Chehalis and Cowlitz Indian Nation are also located within the County.

According to the Lewis County Comprehensive Plan, about 74 percent of land within the County is committed to federal, state, and private resource land uses. Most of this land is primarily used for mineral, agricultural, forestry, and recreational uses. Only 1 percent of the resource land lies within urban areas. Over 98 percent of Lewis County is classified as open space or remote rural areas and less than 2 percent is available for urban or more intense rural development.

The majority of Lewis County is located within Water Resource Inventory Areas (WRIAs) 23 and 26, the Chehalis and Cowlitz River basins respectively. A moderately sized portion of the Nisqually River Basin (WRIA 11) is located within the north central part of the County. Small headwater portions of the Deschutes River Basin (WRIA 13), and the Grays River Basin (WRIA 25) are also located within Lewis County. The major watersheds and streams, including the current county classification are shown in Figure 2.

The County includes the upper Chehalis Valley, much of the Cowlitz River Drainage and numerous other creeks draining the foothills and mountains. The Chehalis River Valley is in the southern part of the Puget Trough and includes broad well developed flood plain and low terraces surrounded by dissected uplands of low to moderate relief with rounded ridges (Evans and Fibich 1987). The Cowlitz River flows from the Cowlitz glacier and the valley extends west about 80 miles from the rugged glacially modified mountains to the southwest part of Lewis County with bottom lands, terraces, and broad plains. The Nisqually River is fed by the Nisqually Glacier on Mount Rainier and follows part of the northern boundary of Lewis County. Small headwater portions of the Deschutes, Elochoman, Grays, and other rivers and creeks are found around the edges of Lewis County.

Tectonic and volcanic activity, glaciation, and rivers have shaped the landforms that make up Lewis County. Glacial advances from the area volcanoes and highlands eroded the underlying bedrock, creating steep mountainsides and depositing glacial sediments such as lake deposits, till, and outwash. The rivers cut through the outwash and carry coarse and fine sediments.

2. FREQUENTLY FLOODED AREAS

For regulatory purposes, frequently flooded areas are defined as “lands in the floodplain subject to a one percent or greater chance of flooding in any given year” (WAC 365-190-030 (7)). This is equivalent to the 100-year floodplain designation mapped by the Federal Emergency Management Agency (FEMA) on Flood Insurance Rate Maps (FIRMs). For rivers and flowing waters, the FIRMs delineate floodplains into two designations:

- FEMA designated floodway—the area of the floodplain that should be reserved or kept free of obstructions to allow floodwaters to move downstream and to prevent substantial increases in flood heights; and
- Floodway fringe—the 100-year floodplain outside the designated floodway.

The floodway is managed for substantial conveyance of floodwaters and for fast-flowing water, while the floodway fringe typically has less significant flow amounts and velocity. The FIRMs also depict areas of floodwater inundation, usually associated with low-lying areas, lake fringes, or areas behind levees that are typically managed for floodplain storage. The 100-year flood is also termed the Base Flood, and the total area subject to flooding during the 100-year flood is the Area of Special Flood Hazard. Existing FEMA designated floodplains are indicated in Figure 2.

Development within a floodplain creates a risk to human health and property. Floodplain development also poses risks to aquatic habitats and species. This includes habitats for Chinook salmon and bull trout, listed as “threatened” and coho salmon, listed as a Species of Concern under the Endangered Species Act (ESA).

WAC 365-190-080 (3) states that counties and cities should consider the following when designating and classifying frequently flooded areas:

- Effects of flooding on human health and safety, and to public facilities and services;
- Available documentation including federal, state, and local laws, regulations, and programs, local studies and maps, and federal flood insurance programs;
- The future flow floodplain defined in the WAC as: the channel of the stream and that portion of the adjoining floodplain that is necessary to contain and discharge the base flood flow at build out without any measurable increase in flood heights.

This chapter discusses frequently flooded areas chiefly from the perspective of flood effects on human health, safety, and property protection, and the effects of human activities on flooding. The authors recognize that floodplain development has the potential to affect all other critical areas regulated by LCC Title 15.35. For the most part, the ecological issues associated with floodplain management will be addressed in the chapters for wetlands, and fish and wildlife HCAs. Floodplain management issues will also be addressed in the chapter for geologically hazardous areas and aquifer recharge areas. One important goal of these reviews will be to ensure that the connection between frequently flooded areas and the other critical areas regulated under LCC Title 15.35 is integrated so that ecological impacts associated with development within frequently flooded areas are adequately reviewed.

2.1 FLOODPLAIN FUNCTIONS AND VALUES

River floodplains convey and store flood waters when river flow exceeds the capacity of the main river channel. As river stages increase, the depth and velocity of the flood water increases, increasing the aerial extent of inundated land and flowing water. Encroachment into the floodplain of a river can increase the flood level in some sections of the river and the subsequent flow velocity. Displaced floodwater (lost floodplain storage) can also increase flooding and flood duration.

Floodplains are also areas of reduced flow velocity. As water overflows from the main channel of a river or stream, it spreads over the land surface, resulting in a much wider flow path over rougher vegetated land. The increased roughness and relatively shallow flow depth result in lower flow velocity which allow for suspended sediment to settle in the floodplain. This provides a mutual benefit for the floodplain and stream, depositing fertile soil and nutrients in the floodplain, and reducing sedimentation in the stream channel.

Floodplains are an interface between groundwater and surface water, providing areas of groundwater discharge or recharge. These areas may vary spatially or seasonally. For example, some areas may always be a discharge or recharge point, based on relatively constant groundwater levels and flow patterns. Other areas may act as a recharge point during dry months when the water table is low, and a discharge point during the wet season when the water table rises. Groundwater recharge and discharge are critical to maintaining base flows, which are in turn critical to maintaining aquatic habitat and water quality during dry months by maintaining wetted channels and delivery of cool, oxygenated water.

Floodplains are also a setting for riparian ecosystems. Riparian ecosystems are found where high water tables, overbank flooding, or channel meandering occur. Riparian ecosystems are highly variable environments, both spatially and temporally. They form a transition between terrestrial and aquatic ecosystems. They are saturated or flooded during most of the wet season, while the water table recedes below the root surface during the summer. Riparian ecosystems have a high flux of energy, water, and other material. As such, they generally have high plant and animal species diversity, high species and biomass density, and high productivity (Mitch and Gosselink 1993).

2.2 OVERVIEW OF INVENTORY

2.2.1 Existing Inventory

FEMA mapping of the 100-year floodplain provides the basis for designation, protection, and regulation of frequently flooded areas. The Lewis County floodplain inventory uses FEMA's mapping (LCC 17.35.220). Areas of special flood hazards are identified by the Federal Insurance Administration in a scientific and engineering report entitled "The Flood Insurance Study for Lewis County" in November of 1981. (LCC 15.35.060) NOAA also provides additional information.

Figure 2. Frequently Flooded Areas

Figure 2. Frequently Flooded Areas

2.2.2 Past Major Floods

The cities of Centralia and Chehalis and surrounding communities in Lewis and Thurston counties have a long history of flooding and flood damage. Episodic flooding has caused extensive damage to private and public property and intermittent closure of critical transportation routes resulting in significant economic losses.

January 1990 Flood

The January 1990 flood was primarily the result of a series of back-to-back storms accompanied by heavy rainfall over the 8-day period January 3-10 (Hubbard 1991). The storm system was quite complex and included high winds and strong surges of precipitation. During the 8-day period, 8 inches of rain were recorded at the Centralia climatological station maintained by the National Weather Service (NWS). This represents 19 percent of the average total yearly precipitation recorded at that station. The most intense precipitation in the basin occurred near the headwaters of the Skookumchuck and Newaukum rivers. The surges in precipitation resulted in more than one flood peak in many of the basin's streams, and streams did not return to normal seasonal river stage (base flow) between storm surges. The early precipitation saturated soils in the basin and significantly increased the flooding potential when the heaviest rains arrived on January 9. Peaks of record, up to this event, were recorded at the Chehalis River gaging stations near Doty, near Grand Mound, and at Porter. These flood peaks were estimated at the time as the 100-year flood.

November 1990 Flood

Above average precipitation in October and early November resulted in saturated soils that contributed to the flooding potential when a major storm arrived November 21 and lasted until November 25 (Hubbard 1994). Wet weather accompanied by cool temperatures in the first part of November lowered snow levels to approximately the 1,000-foot elevation. The Cascade foothills received 6 inches of snow at elevations of 1,000 to 2,000 feet, 12 inches at 2,000 to 3,000 feet, and 12 to 18 inches at 3,000 to 4,000 feet. As a warm front moved through western Washington on November 21, the snow changed to rain, and rising temperatures caused melting of snow up to elevations of 5,500 feet. Over the next three days, intense rain fell on drainages where streams were beginning to swell from snowmelt, and severe flooding followed. Floodwaters receded when a cold front moved into the area on November 26, lowering freezing levels and diminishing precipitation. These flood peaks were estimated at the time as the 75- to 100-year event.

February 1996 Flood

To date, the February 1996 flood is the flood of record on all the major drainages in the Chehalis River basin. By February 5, soils throughout the basin were at or near saturation from above average precipitation that had fallen in the preceding weeks (USACE 1996). An earlier cold snap had caused snow to fall as low as the 500-foot elevation. Warm, moist subtropical air being transported from the Pacific Ocean caused freezing levels to rise above 8,000 feet and resulted in warm, moist rains on the snow pack in the foothills. A strong, polar jet stream extending into the central and western Pacific Ocean sustained and strengthened storms as they moved into the area off the eastern Pacific. An atmospheric blocking pattern caused stationary major troughs and ridges around the Northern Hemisphere. The Pacific Northwest was situated between a trough to the west and a ridge to the east, creating a condition for weather systems to be at maximum strength when they reached the area. The atmosphere remained in this general pattern for at least 96 hours, during which large amounts of rain fell and quantities of water were released from the snow pack as stream flow. These flood peaks were estimated at the time as another 100-year flood.

2.2.3 Updates to Inventory

FEMA initiated a nationwide effort in 1997 to modernize the flood mapping program (FEMA 2001). The updated maps will use digital orthophotogrammetry to produce more accurate base maps, from which improved floodplain boundaries will be delineated. In conducting the Map Modernization Program, FEMA will consult with, receive information from, and enter into agreements or other arrangements with state, regional, and local agencies to identify floodplain areas. The intent of using local agencies is to provide more accurate representations of floodplain conditions (FEMA 2003). This update effort is underway in Lewis County and is scheduled for completion in 2007.

2.2.4 Alluvial Fan Hazards and Channel Migration

Alluvial fans and channel migration are addressed in the Geological Hazards BAS report, but are summarized here because the hazards overlap with and are often addressed by flood control regulations.

Alluvial fans are landforms built by sediment deposition and channel migration. Alluvial fans are localized areas of increased sedimentation downstream of locations where laterally confined creeks or rivers expand (Collinson 2002). During floods, sediment and other materials are deposited on the upper fan, shifting the main flood channel to either side or the center of the fan. In narrow high-gradient valleys, landslides or debris jams can temporarily dam the valley and then break, forming a dangerous dambreak flood and debris flow that surges downstream, depositing sediment and debris across the alluvial fan. Most of the fans in Lewis County are built at the mouth of mountain streams, and are formed by both river and debris flow events.

Development has been common on alluvial fans because they are outside the main river floodplains; are relatively flat compared to the steep valley walls; are well drained; have easily accessible water supplies; and generally have great views of the surrounding landscape. These qualities make alluvial fans attractive development sites along the valley edges of Lewis County. The hazards of building on alluvial fans may not always be apparent in humid regions because dense forest cover gives the false impression that the alluvial fans are inactive (Orme 1989). In addition, incision of the main channels, formation of apparent terraces, short-term channel stability, sediment routing, and the complex response of stream channels can be difficult to interpret even with extensive detailed investigations and analysis (Cazanacli et al. 2002; Whipple et al. 1998; Muto and Steel 2004).

In the channel migration zone of alluvial fans, development are at risk of destruction. Considerable planned or emergency shore armoring, dredging, diking, and other measures are required to control channel migration on developed alluvial fans.

Alluvial fans and adjacent areas are presently not explicitly regulated in Lewis County. The purpose of alluvial fan regulations is to avoid or minimize the loss of life and damage, without the need for flood control devices or dredging to allow for natural hydrologic changes along rivers and streams.

Channel migration is a natural process. Stream channels adjust over time to the watershed, valley bottom, and flood conditions. Channel banks erode and shift in response to these flood flows. Deposition and erosion along the streams and especially on alluvial fans and deltas can frequently change and the whole river or creek channel can shift or jump (channel avulsion) across the channel migration zone. Channel migration areas are defined as areas subject to risk due to streambank destabilization, rapid stream incision, stream bank erosion, and shifts in location of stream channels.

As part of the Comprehensive Flood Hazard Management Plan (CFHMP) amendment probable hazard areas were identified for the Upper Cowlitz River Basin, the Upper Cowlitz River, Rainey Creek, Tilton River, and Cispus River. Lewis County adopted the CFHMP in May of 2001. The CFHMP addresses several flood-related issues including reducing public exposure to risk and property damage from flooding. The plan identified direct relationships between property loss/damage from bank erosion and various types of channel migration (GeoEngineers 2003).

Data for the Nisqually, Cowlitz, and Cispus Rivers indicate an increased potential for channel migration along portions of those rivers. This is due to the large runoff and sediment transport capacity of these rivers; the large sediment supply from mountain slopes, volcanic, and glacial processes; and the stored sediment along the valley bottoms.

See the Geological Hazards BASs Review for more detailed discussion and maps.

Designation and regulation of human activity in channel migration areas provides greater long term avoidance of risks to life and property, as well as maintaining more natural stream processes than regulating floodplains alone.

2.3 HUMAN ACTIVITY AND FREQUENTLY FLOODED AREAS

The most common types of human disturbance to floodplains are filling, channelization, and creation or alteration of barriers, and alteration of land cover. Each of these is described below.

Filling

Filling is typically performed to raise an area above the flood elevation so that it may be developed. Without compensatory volume replacement, filling would reduce floodplain storage. Additionally, fill in the floodway (where water is likely to be deepest and fastest) will potentially create constrictions that increase flood heights. FEMA model regulations require that the cumulative effect of a proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than 1 foot at any point within the community. Encroachments into the floodway are typically prohibited unless it is demonstrated that the floodway is not correctly depicted or the encroachment will not result in any increase of flood levels during the base flood. This is the standard in LCC 15, 35, 310. Encroachments in the floodway fringe up to the floodway are allowed because the increase flood levels typically does not exceed the allowable regulatory level of 1 foot during the occurrence of the 100-year flood discharge (FEMA 2004b). The Lewis County standard is more stringent for the flood fringe.

Channelization

Stream or river channelization can be described as the deliberate or unintended alteration of channel slope, width, depth, sediment roughness or size, or sediment load (Bolton and Shellberg 2001). Widening, deepening, dredging, removal of live or dead vegetation, bank armoring, straightening, and construction of levees or similar structures may alter these variables. The physical effects of channelization include higher flow velocities, increased sediment transport, increased channel incision, bank instability, loss of channel and floodplain capacity, increased flood heights, and draining of wetlands and floodplains. These effects result in damage to or loss of stream and wetland habitat (Bolton and Shellberg 2001). Channelization also results in loss of natural habitat-forming processes, and even intentional homogenization of the channel. As a result, channel complexity is reduced, and specific habitat types (pool-riffle sequences, logjam-formed pools, meander pools, etc.) are reduced or eliminated. Loss of specific habitat types (pools, eddies, and off-channel areas), increased flow velocity, and longer durations of elevated flows affect fish, invertebrates, and periphyton

(an important source of food) by sweeping organisms downstream, and by scouring food or redds.

Filling and channelization also reduce the water quality maintenance function of floodplains, through loss of wetlands and floodplain vegetation that filter sediment, nutrients, and chemicals, and by reducing the volume of flood flow that interacts with the floodplain outside of the channel.

Barriers

Barriers are features that restrict the movement of water, sediment, animals (fish), or other material such as large woody debris (LWD), either downstream or laterally within the floodplain. Barriers may also restrict channel migration. Barriers include levees, road and highway embankments, bridges and culverts, floodplain fill, bioengineering structures (cribwalls, rootwad/rock mixtures, etc.), and walls. Levees protect infrastructure from flooding. Levees also affect conveyance and storage of floodwaters in two ways: (1) levees isolate naturally occurring floodplain storage from the channel, and (2) levees constrict flows to a narrower channel, resulting in increased flow depth and velocity. This may cause increased scour, sedimentation, and transference of flooding problems to downstream areas (Hey 1994). Other types of barriers such as road embankments, bridges, culverts, fill, and embankments may impede flow, causing greater flood heights. Levees also physically disconnect riparian areas, wetlands, and off-channel habitats from the main channel, which has adverse effects on natural ecological processes (Bolton and Shellberg 2001).

2.4 FLOOD CONTROL PROJECTS

There are a variety of existing flood control facilities in Lewis County constructed and maintained by special districts. Flood Control and Diking Districts are indicated in Figure 3. The major existing facilities include:

Skookumchuck River levees are located along the left bank (southern side) of the Skookumchuck River, a distance of approximately 1,400 feet from below the confluence of Hanaford Creek to G Street in Centralia. The riverbank levee was originally built in 1934 and portions were rebuilt in 1997.

Lewis County Flood Control District #1 (LCFCD#1) covers a section of Dillenaugh Creek and Dilleytwig Creek between Bishop Road and Jackson Highway and includes the Chehalis Industrial Park. The district privately funded a creek modification project that widened the creek near the industrial area to increase the conveyance capacity.

Lewis County Flood Control District #2 (LCFCD#2) encompasses properties in the City of Centralia, Centralia's UGA and Lewis County between Interstate 5 and the Chehalis Western Railroad grade. This district is responsible for a 2200-ft long levee designed to provide a 45-year level of protection from Salzer Creek bank overflows. The COE performed the feasibility study and construction. The project was completed in September 2000.

Coffee Creek within the City of Centralia and unincorporated Lewis County is maintained in a created channel by a system of levees and revetments maintained by a local Drainage and Diking District.

On the Cowlitz River north of Packwood near the High Valley Park #6 Subdivision, a revetment was constructed along about 1,000 feet of the south river bank after a 1977 flood overtopped the bank at a sharp meander in the river. The revetment is maintained by the subdivision owners.

Figure 3. Frequently Flooded Areas Special Districts

On Butter Creek near its juncture with the Cowlitz River approximately 1.5 miles northeast of Packwood, riverbank revetment was constructed in 1987 on each side of the creek. It was extended in 1998.

On Silver Creek at its confluence with the Cowlitz River near the town of Randle, the Soil Conservation Service (SCS) constructed a revetment in the early 1970s to control flooding on this alluvial fan. The major facility protected by the levee is the public school in Randle. Lewis County maintains the levee and typically replaces riprap material following floods. (LCPW 2004)

Since 1935, the U.S. Army Corps of Engineers (USACE) and other agencies have proposed numerous structural flood control measures to prevent flood damages in the Centralia/Centralia area. These efforts include investigation of multipurpose storage reservoirs on the Chehalis River and various tributaries, small headwater dams, channel clearing, alternatives for channel dredging, alternatives for levees, pump stations for tributaries, and combinations of these flood control measures. None of the major structural flood control measures proposed have been approved or constructed. The two main reasons for this are, 1) a low project benefit-to-cost ratios preventing cost-sharing participation by the COE, and 2) the absence of cost-sharing by sponsoring agencies, such as the cities of Centralia and Chehalis or Lewis County. Other concerns include environmental considerations and regulatory approvals (LCPW 2004).

After the February 1996 flood, Lewis County established a flood control zone district. The County has sponsored a variety of studies but has not adopted or implemented a flood management program (LCPW 2004). At this time there is no levy assessed for the countywide flood control district.

2.5 FLOOD HAZARD MANAGEMENT PLANNING

The Disaster Mitigation Act of 2000 (44 CFR 201) requires state, local, and tribal governments, taxing districts and not-for-profit organizations to develop Hazard Mitigation Plans (HMPs) to remain eligible for FEMA pre-disaster mitigation and post-disaster relief funding. The HMP identifies hazards (such as flooding, volcanic, landslide, seismic) that could potentially affect or be present in a community or area, and estimates the level of risk these hazards pose in the event of a natural disaster. These risk estimates are then used to prioritize mitigation planning efforts. The law requires that each HMP include the following elements:

- Public involvement
- Planning process documentation
- Risk/vulnerability assessment
- Mitigation strategy(ies)
- Plan maintenance and updates
- Formal plan adoption by each participant

Updates to the HMP are required every five years under 44 CFR 201.6(c)(4)(i) and the jurisdictions of Centralia, Chehalis, and Lewis County are responsible for the maintenance and coordination of the update. The Lewis County Public Works Department is responsible for ongoing data management for the HMP.

In addition to coordinating with external agencies, Lewis County's flood response includes the mobilization of observers to evaluate field conditions during floods. During a flood, staff

from the Engineering Division of Public Works travel throughout their assigned sectors and report back to River and Flood staff on actual flooding conditions throughout the event. River and Flood staff work with the Department of Emergency Management (DEM) and Maintenance and Operations to prioritize problem areas and take appropriate measures to ensure public safety, minimize the loss of public and private property and inform the public of current and expected flood conditions. Once a problem area is identified in the field, the situation is assessed to evaluate whether actions can be taken to minimize damages. When appropriate, sandbagging operations are initiated.

3. GAP ANALYSIS AND CODE OPTIONS

This section analyzes the existing code for potential deficiencies in meeting the requirements of RCW 36.70A.

GMA Guidelines in WAC 365-190 do not provide specific guidelines for how hazards to human health and safety from frequently flooded areas are to be addressed. CTED policy interpreting the GMA discourages allowing any new development within a floodplain. However, if a local jurisdiction does allow for this, the CTED guideline for density in a flood plain is 1dwelling unit per 10-20 acres.

This can be considered more restrictive than the FEMA/Ecology guidelines, which do not specifically regulate or prohibit development densities in the floodplain so long as minimum flood guidelines are met (flood-proofing electrical, building the structure above the 100-year flood level, ensuring that development does not raise downstream flood levels, etc.). The interrelationship of frequently flooded areas with other critical areas means that all important functions and values need to be considered in establishing comprehensive plan policies and development regulations for these critical areas (CTED 2004). To address this policy, the CTED Example Code proposes requiring all structures, utilities and other improvements be located outside of floodplains unless a site has no buildable area outside of the floodplain (CTED 2003).

Growth Management Hearings Board decisions on frequently flooded areas are limited. The most relevant clarifies that location of development within a floodplain is an issue.

“Ordinances which merely regulated building requirements within a floodplain and did not address issues of whether and under what conditions building should occur in a floodplain did not comply with the GMA.” WWGMHB Diehl v. Mason County 95-2-0073 (Final Decision and Order, 1-8-96)

Existing Lewis County Critical Areas provide the following standards for frequently flooded areas:

Development within designated frequently flooded areas shall be in compliance with Chapter 15.35 LCC, as now or hereafter amended, and/or the Lewis County shoreline management master program, as now or hereafter amended. LCC 17.35.830.

The County Comprehensive Plan has a number of policies relating to floodplains, including:

Policy NE 1.5 Residential development should be discouraged and/or mitigated within the 100-year flood plain and prohibited in the floodway or that area which includes the center of the channel of a creek, stream or river and that area which carries the majority of water during a flood.

Policy NE 4.1 Preserve hazardous areas (subject to geologic and flood hazards) as open space wherever possible.

OBJECTIVE NE 5 Life and property should be protected from flood hazards, and the flood storage and transmission capacity of rivers and streams should be retained.

Policy NE 5.1 The County should give priority to such land uses as forestry, agriculture, public recreation, or water dependent uses in areas subject to flooding to minimize the hazards to life and property. Other developments in the floodplain should be of low priority and constructed to avoid damage from floods, including compensating design features.

Policy NE 5.2 The County should maintain storage and transmission capacity of floodplains by prohibiting filling of wetlands and discouraging filling elsewhere in the floodplain. Where filling is permitted the carrying capacity and storage of the streams shall be protected.

Policy NE 5.3 The county should prohibit encroachment in floodways except for the purpose of stabilizing channels against erosion in order to protect agricultural lands, public roads and bridges, existing public or private structures to achieve habitat enhancement.³

There are three basic approaches to limiting flood exposure by limiting new development:

- a) Limiting the types and density of uses allowed in floodplains by zoning these areas for resource use rather than for residential, commercial and industrial use.
- b) Limiting or prohibiting subdivision within these areas, or requiring new lots to have a buildable area outside the floodplain.
- c) Requiring new construction on existing parcels to locate outside of the floodplain if a buildable area is outside the floodplain.

3.1 HIGHER FLOOD STANDARDS

After the February 1996 flood, it was generally confirmed that the FIRMs developed by FEMA in 1981 needed to be updated. (LCPW 2004)

Lewis County, Chehalis and Centralia are in the process of implementing a cooperative study with FEMA to update the current floodplain maps in the area using the 1996 flood as the basis. In 1997, the County developed a hydraulic (UNET) model of the Centralia-Chehalis valley in WRIA 23 after the February 1996 flood. With the assistance of state and federal agencies interested in the application of the model, the area model simulation was expanded and updated. In 2003, the County undertook a Cooperative Technical Partnership (CTP) agreement with FEMA to work on developing new and updated digital FIRMs and flood insurance studies for the unincorporated areas of the county in WRIA 23 (LCPW 2004). This work is being done in phases with the first phases covering the most urbanized portions of the county. This should provide maps that revise the extent of the floodplain as well as provide elevation information.

Smaller tributaries and the Cowlitz River are not currently not being re-studies. Several options are available for those areas.

- Use of historical flood data to justify higher elevation requirements than specified on the FIRM is a method for improving the flood hazard protection program without large cost to local government. If local information suggests that flood elevations are actually higher than those shown on the FIRM, the community may adopt the higher standards for their regulatory program. The local data may originate as historical observations, higher water marks, or photographs of past flooding. These higher standards will not affect insurance rate zones, but the higher standards will provide a higher level of flood protection to residents of the area.
- The community itself may commission (and pay for) a restudy. Once the restudy is completed, the results must be submitted to FEMA for review. If FEMA finds the study acceptable, they will revise the FIRM.

³An exemption for stabilizing channels for protection of agricultural land may conflict with FEMA regulations

- A less detailed approach is through a "Letter of Map Revision." This option allows the community to provide FEMA with data supporting modification to the FEMA map. FEMA will issue a letter that describes the changes and officially revises the effective map based on the data provided by the community. A simpler version of the "Letter of Map Revision" is called a "Letter of Map Amendment" which applies to individual or multiple parcels.

3.2 RESTRICTIONS ON USES AND DENSITY

The restriction of development in the floodplain has a threefold purpose:

- (1) to reduce risk to human health, safety, and property;
- (2) to prevent development activities from adversely affecting the capacity of the floodplain or floodway to convey and store floodwaters; and
- (3) to preserve important ecological functions of floodplains.

Lewis County currently designates substantial portions of the Chehalis River floodplain as part of the Urban Growth Boundary (UGB) for the cities of Centralia and Chehalis, as indicated on Figure 4. These areas are subject to a variety of urban uses. Existing flood control levees provide varying levels of protection to some of the UGB.

Outside the UGB, the floodplains are predominantly in low density rural and agricultural zoning districts. Figure 4 also indicates zoning that allows residential densities at ranges of less than 1 unit per 5 acres and between 1 unit per 5 acres and 1 unit per 20 acres as well as commercial and industrial uses. Some of these areas are currently developed.

The County has the option of considering reduction of flood risk to future residents and to non residential uses by further limiting the range of uses allowed in floodplains. Currently, developed areas could be rendered non-conforming, which would place additional limitations on future expansion. Further restrictions in allowed uses should be weighed and balanced against other goals of the Comprehensive Plan.

An additional less restrictive option is to prohibit certain uses such as critical facilities (e.g., schools, hospitals, emergency response facilities) anywhere within the 100-year floodplain. The primary purpose of such a prohibition is to protect the critical facilities to ensure their operation during floods as opposed to protecting floodplain storage. LCC 15.35.300 does not prohibit critical facilities within the floodplain, but requires more stringent flood proofing, including access routes above the level of the 100 year flood. This addresses situations such as flooding of access to the areas hospital in the January 1990 flood. The hospital, on Cooks Hill Road in Centralia, was not flooded, but all access routes to the hospital were inundated causing the hospital to be inaccessible from the ground and requiring helicopter service for emergencies (LCPW 2004). A more restrictive provision would limit the establishment of new critical facilities in floodplains. It also might present an impediment for expansion of existing facilities.

An additional potential provision is designating primary emergency roads and preparing a plan for ensuring that they are usable during the base flood. Because of the public health and safety benefits of such routes, a storage exemption for raising these roads could be considered.

An additional option is to prohibit new structures or expansion within the floodway unless it can be demonstrated that the proposed encroachment would not result in any increase in flood levels during the 100-year flood. The purpose of this regulation is to protect floodplain

storage and conveyance. Such a provision is incorporated in existing Lewis County codes (LCC) in LCC 15.35.310 and is similar to the CTED Example Ordinance.

3.3 FLOODPROOFING

Floodproofing is designed to limit the damage from flooding. In a flood situation, individuals are often evacuated, but with adequate floodproofing they can often return to their property after the flood and resume activities with little need for repair.

LCC 15.35 and the CTED Example Ordinance require floodproofing of new development and substantial improvements to existing development within the floodplain, to reduce damage to structures during floods. Key floodproofing provisions include the following:

- Anchoring to prevent flotation, lateral movement, or collapse;
- Construction of utilities to prevent entry of water during flooding;
- Elevation of residential structures to or above the base flood elevation (BFE);
- Prohibition of enclosed areas below the lowest floor, or allowance for flow of floodwaters; and
- Elevation of non-residential structures above the BFE or floodproofing so that portions of the structure below the BFE are watertight and non-buoyant.

LCC requires that new construction and substantial improvements of residential and nonresidential structures within shallow flooding areas (AO zones) shall have the lowest floor elevated one foot or more, above the depth number specified on the FIRM (at least two feet if no depth number is specified) or BFE (LCC 15.35.320). As noted in LCC 15.35.310 and the Model Ordinance, encroachments within the floodway are prohibited unless it can be demonstrated that the proposed encroachment would not result in any increase in flood levels during the 100-year flood.

An additional measure to address flow barriers is to require new or expanded roads, bridges and levees to be analyzed for impacts on flooding and to be redesigned or retrofitted to provide for free movement of floodwaters. Levees must meet the 1-foot rise standard.

Figure 4. Frequently Flooded Areas and Zoning

Figure 4B. Frequently Flooded Areas and Zoning

3.4 FINDINGS AND CODE RECOMMENDATIONS

In its present form, the Lewis County Code regarding frequently flooded areas represents the lower range of regulation required for eligibility for the FEMA flood insurance program.

The following table summarizes recommended additions to the Lewis County regulations.

Functions and Values Findings and Recommendations	
Finding	Lewis County Comprehensive Plan Policies recognizes floodplains primarily as a threat to health and safety. Policies do not recognize the value of frequently flooded areas for maintaining and providing fish and wildlife habitat, or that natural floodplains, stream channels, and natural protective barriers help accommodate and convey floodwaters.
Options	Add new language establishing that, in addition to reducing the risk to life and property damage, frequently flooded areas should also be managed to provide an ecologically necessary flow regime and to form, maintain, and provide access to a full range of functional salmonid habitats.
Designation and Classification of Flood Hazard Areas	
Finding	Additional data on flood prone areas and flooding levels has been collected during recent severe floods. This data may differ from FEMA data. New or additional data could be used to improve floodplain management and floodproofing of new development in floodplains. FEMA does not prohibit the use of best available data for regulating floodplains. This is an interim step that can be used in lieu of or until FEMA updates the maps
Options	Lewis County is in the process of using the best available data from recent floods to update FEMA maps of the Chehalis River. This data should be adopted and used as the basis for regulation in these areas.
Finding	Small streams and rivers may not have detailed flood studies or designated floodways for appropriate floodplain management.
Options	<ul style="list-style-type: none"> • Perform additional studies to identify floodplains and floodways on selected streams. • Develop a regulatory method to be applied to unstudied streams to provide some level of flood protection. • Collect and record best available data on unstudied streams for use in floodplain management.
Finding	Alluvial fans and channel migration provide additional risks to human safety and property.
Options	Perform additional studies to identify alluvial fan hazards and map channel migration zones and apply regulations (See Geological Hazards BAS report).
Flood Hazard Management Findings and Recommendations	
Finding	Lewis County does not currently restrict the range of uses allowed in floodplains.
Options	<ul style="list-style-type: none"> • Review existing zoning and UGA designations to consider prohibition of certain uses in floodways and floodplains. • Restrict new or expanded critical facilities located within the floodplain. • Restrict agricultural uses or structures that could have an adverse effect on adjacent lands. • Allow uses such as public road crossing and habitat restoration that meets allowable floodway management standards.

Flood Hazard Management Findings and Recommendations (continued)	
Finding	Codes do not currently recognize the special features of flooding related to alluvial fans or debris flows.
Options	Revise codes as provided in the Geological Hazards BAS Report.
Finding	Lewis County does not require new or expanded roads or other facilities to be reviewed and retrofitted to reduce barriers to flood water movement.
Options	Add provisions to require analysis of the effects of new, expanded, or substantially reconstructed public and private facilities on flooding to identify flow barriers and provide authority to require retrofitting to reduce barriers to flood movement.
Finding	Lewis County uses the FEMA standard of a 1-foot maximum allowable flood elevation rise.
Options	Assess whether a lower allowable rise may be appropriate for some flood prone areas, in conjunction with floodplain storage compensation.
Finding	Lewis County does not explicitly require floodplain storage compensation.
Options	Revise codes to require floodplain storage compensation under most conditions.
Finding	Lewis County uses the FEMA standard of a 1-foot maximum allowable flood elevation rise.
Options	Consider requiring lowest finished floor or floodproofing elevations 1-foot above the FEMA flood elevation plus the dimension of uncertainty established either by statistical means or by comparison of the FEMA elevation with record floods.
Finding	Lewis County does not have an emergency access plan that identifies critical transportation and emergency access routes for flooding emergencies.
Options	Incorporate in the county a Flood Response Management Plan that identifies critical transportation and emergency access routes. Require new and reconstructed roads to be safe from flooding during the regulatory flood. Develop an improvement plan to raise and floodproof at-risk roads designated in the emergency plan.

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